MINNESOTA ENGINEERING PROCEDURE

DIVERSIONS

This procedure applies in general to all diversions whether used as a single practice or in combination with other practices as components of a total system.

Practice Standard Diversion (362) has criteria for design of diversions. The Engineering Field Handbook, Chapter 9, has guidance on planning, design, layout, construction, and maintenance of diversions. Practice Standard (362) requires that vegetation will be established according to Practice Standard Critical Area Planting (342) and Mulching (484). Practice Standard (362) requires that diversions be operated and maintained properly. The owner/operator shall be advised of the physical effects of this practice on his resource concerns.

Before Construction

A. Job Investigations

1. Is there an adequate and stable outlet.
2. Check watershed sizes, slope, land use and soil type.
3. Is there a low flow or base flow condition?
4. Consider how it fits in farming operation and any crossings for equipment or other vehicles.
5. Can vegetative protection be established (need for fertilizer, lime, mulching or riprap)?
6. Legal problems or swampbuster issues (cutting of water to wetland).
7. Note observed buried or above ground utilities on site.
8. Determine engineering job class.
9. Prepare operation and maintenance plan.

B. Design Survey

1. For diversions where drainage areas are small, topography is reasonably uniform, elevations with respect to other structures are not important, the engineering survey notes should follow Technical Release No. 62 standard format for engineering notes - figure 2-3, page 2-23 through 2-25. Survey notes are to contain the following information:
   a. Sketch showing location of diversion and watershed and subwatershed boundaries.
   b. Significant characteristics in the watershed such as culverts, road crossings, fence crossings, waterways, or other items that may affect the flow of construction of the diversion. Indicate outlet.
   c. Diversion grade as determined using an engineer's level or other appropriate equipment. Take centerline shots a minimum of every 100 feet along the centerline of the proposed diversion to determine the grade.
   d. Typical cross sections will be taken to determine the volume of earth work. A temporary bench mark should be established on larger diversions or those where there is considerable cutting and filling.
   e. The length of the diversion using a tape, chain, or other devices which will insure the final recorded length is accurate.
   f. Outlet information.
2. For larger diversions where considerable cut and fill are required and where vertical control is important, the survey notes should follow the format in Figure 2-7 pages 2-35 to 2-41 of Technical Release No. 62.

C. Design

1. Design in accordance with Minnesota Practice Standard (362) found in Section IV of the Technical Guide. Approved design charts and tables are found in the EFH, Chapter 9.
2. Design information can be shown on MN-ENG-52, Diversions. Computer printouts and drawings similar to those shown on the above form can be used instead. Design information can be shown in the field notes in lieu of using the above worksheets. Additional field note sheets will be used as necessary to show equivalent information to that shown on the above forms. These field notes can be considered the plan for small jobs. Complexity of job or if used in combination with other structural measures such as outlet structures, underground outlets, waterways, or ag waste structures will require more detailed drawings and data sheets. When the design is shown in the field notes, they should show the following:
   a. Watershed area and characteristics design frequency and peak flow from watershed or each sub-watershed.
   b. Profile and cross sections.
   c. Total length, top width of ridge, bottom width of channel, length of fill, and side slopes for ridge and channel for each design reach.
   d. Design grade, velocity used, and allowable velocity.
   e. Quantity computations used for estimating costs or determining seeding areas.
   f. Vegetative specifications.
   g. Note which Minnesota Construction and Material Specifications apply to this job.
3. Determine seeding quantities. If earthwork volumes are needed, they will be determined by the method of average cross sectional end area.
4. Complete MN-ENG-098, Utility Checklist. Review with landowner/operator the design, O&M Plan, and give the landowner the MN-ENG-098 Utility Notice to complete.

Construction

A. Layout

1. Check for underground and above ground utilities from available maps, completed MN-ENG-098 by landowner, site visit checklist, and contractor notification of Gopher State One-Call. Upon receipt of the GSOC ticket number, print and file the ticket.
2. Set cut and fill stakes or some marker at least every 100 feet to indicate bottom width, top width, side slopes, depth of cut for channel, and height of fill for ridge. As the diversion become more complex with cutting and filling, it will be necessary to set offset cut or fill stakes, and slope stakes. Mark cuts and fills on stakes that will not be disturbed during construction. Flag or mark the centerline.
3. Review design, plan, specifications and staking with contractor.

B. Construction Inspection

The National Engineering Manual (NEM), Part 512 contains NRCS policy on the various aspects of construction inspection activities.

1. Hold a pre-construction conference with the landowner and the contractor.
2. Inspection personnel with proper approval authority will inspect construction to the fullest extent possible, especially work that is not readily observed after installation.

After Construction

A. Checking

1. Make a visual inspection of completed diversion.
2. Record field checkout notes for original design and layout surveys following the format in Technical Release No. 62, Figure 2-3, Sheet 3 of 3, Page 2-25.
3. Record channel and ridge rod readings at 100 foot stations. If offset cut stakes were established and they have not been disturbed, a hand level may be used; otherwise, an engineer's level or equivalent must be used so that station rod readings are tied together to show grade.
4. A minimum of one cross section is to be taken for each design reach not to exceed a 400 foot interval. This cross section is to include the ridge and back slope. Cross sections should be taken at the same location as taken during the design survey.
5. Record length and method of measuring.
6. Record seeded width and observations on conditional and adequacy of vegetation.
7. MN-ENG-52 will be used to obtain certification that the practice meets NRCS Standards and Specifications, in cases where non-NRCS personnel design or certify construction of this practice.
8. Certification statements must state that the practice meets or does not meet NRCS Standards and Specifications, be signed and dated. Certifications can be made on MN-ENG-52 if it was used for design and construction check information. Certifications can also be made on the checkout notes or drawings if it contains the above noted statement.

B. As-built Plans

1. As-built plans are to be prepared for all major structural (Class V and greater) works of improvement. As-built plans for minor (Class I-IV) structures are to be prepared as determined by the person having job approval authority. See NEM 512.52 regarding as-built documentation.
2. Any changes made during construction to the original design should be documented in the design folder and approved by the person with the design approval authority.
3. For guidelines on the as-built plans of complimentary conservation practices, refer to the appropriate Minnesota Engineering Procedure.

C. Minimum Documentation to be included in Case File.

1. Design folder including survey notes and prepared drawings.
2. A list of applicable construction and material specifications, and construction notes.
3. Utility Notice and Checklist, MN-ENG-098 and GSOC printout.
4. Seeding, fertilizing and mulching plan and certification or observation statement on condition or adequacy of vegetation or compliance with recommended plan.
5. Operation and Maintenance Plan.
6. Checkout survey field notes and any calculations of quantities for payment items. Include as-built plans and completion reports if they were required.